Development of a Tabletop Method to Refine Products and Improve NWS Impact-Based Decision Support Services

Daphne LaDue[1], Alex Marmo[1], Ivy Jeffries*[1], Zakiya Johnson*[2], Bruce Pollock*[1], Conner Hurlocker*[1], Gretchen Gillenwater*[3,4], Dereka Carroll[2] , Harvana Liang*[2], Jayla Iglehart*[2], Jill Olson*[1], and Luigi Meccariello[5]

[1]University of Oklahoma, [2]Jackson State University, [3]National Weather Center REU Program,
[4]North Carolina at Pembroke, and [5]National Weather Service Amarillo Forecast Office

denotes undergraduate student

Introduction / Motivation

The NWS is tasked with providing "...relevant information and interpretive services to enable core partner's decisions…" that ensure public safety. —*Weather Research and Forecasting Innovation Act of 2017*

New tools such as probabilistic outputs from ensemble models are coming online.

WFOs need to be able to rapidly test and refine innovations in decision support and collect feedback to assure they meet user's decision needs.

NOAA's call for *developing methods* provided a unique opportunity to center students and help them build and test tools, and then reflect upon their efficacy, while helping to conduct the work.

Methods and Data

Methods:

- Collaborate with WFO on their goals, questions
- Conducted tabletop exercises and interviews with Local Weather Decision Groups
- Recorded and professionally transcribed
- Qualitatively coded transcripts thematically
- Inductive and deductive thematic codes analyzed
- Provide analysis to WFO regarding slides/graphics of particular interest to them
- Analyze efficacy of questions to elicit information
- Create guidelines for NWS WFOs to replicate this activity
- Survey of key graphics was added for exercises with high attendance

Development of the Method

We learned:

- It helps to have a "naïve" person leading discussion, putting participants in a teaching mindset

Our guide includes sections on:

- Guide on how to plan and run the exercise
- Step-by-step task list
- Question scripts

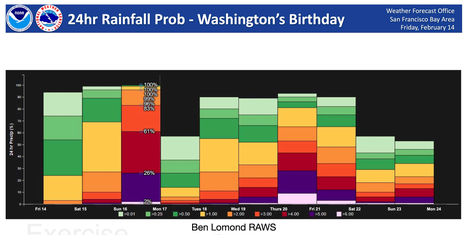
Limitations

- Participants may not be representative of all NWS core partners for each WFO
- Partner offices should consider their knowledge of partners when choosing who to invite to follow-on exercises.

Results from the Exercises

	Type of Weather	What Was Tested	Format of Session	Types of Partners Involved
WFO-1	Winter, Flooding	1) Weekly webinar 2) Expression of forecaster certainty	Interviews after Routine Weekly Webinars, Realtime Weather	City/County EMs, Transportation, School-Univ., State Parks, County Executive, Utilities
WFO-2	Convective severe, Flooding	1) Timing of a multiple hazards 2) General understandable/usable 3) Multiple forms of storm timing	Tabletop Exercise	City/County EMs, Transportation, School-Univ., Public Works, Health, Law Enforcement
WFO-3	Convective severe, Flooding	1) General understandable/usable 2) Probabilistic rainfall and Probability of exceedance	Tabletop Exercise	City/County EMs, Utilities, Public Works, Fire, Other
WFO-4	Flooding	1) Words vs Confidence sliders 2) 10th /90th percentiles and Probability of exceedance 3) Hydrographs vs Matrix 4) Detailed timing	Tabletop Exercise	City/County EMs, Schools, Health
WFO-5	Flooding	1) Timing of email briefing 2) Probabilistic rainfall and Probability of exceedance 3) Relative risk or Hazard Matrix	Tabletop Exercise	City/County EMs, Fire, Law Enforcement, Public Works, County PIO, Transportation

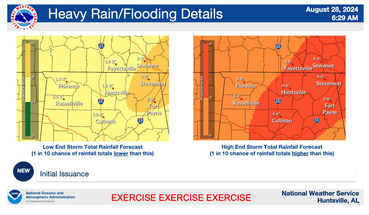
Probabilistic Information ~Welcome, Requires Interpretation



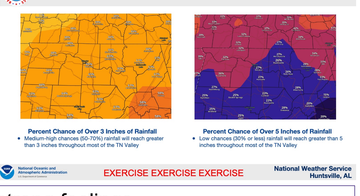
Ben Lomond RAWS Forecast

From Exercise 3

- Local officials do not like to be caught off guard: "How possible is the worst-case scenario?"
- Loved by a few *but* interpretation necessary for most. "They don't ever just vomit information and expect us to figure it out. It always comes with a guide."
- All wanted a time breakdown <24 hrs; 6 hr intervals were used in Exercise 5
- For Exercise 3, the probability of exceedance depicted a 25% likelihood of going over 5", a clarity that was "more available to my brain"; the box and whisker plot did not depict the range of possibilities.
- Helps plan staffing, provides a preparation timeline.

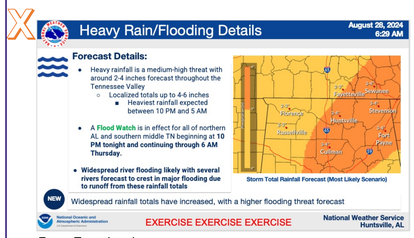


From Exercise 4



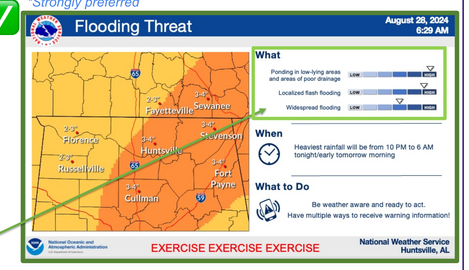
- No strong feelings.
- Some only wanted the low end / high end ranges, an "overall view of the [forecast]."
- However, one county recognized the additional, important information: the high-end rainfall was 4–6", with around "a 30% chance of that occurring," — which was notable.
- With any probability graphic: "You guys do this for a living…I want to hear, what is your opinion on it?"

Confidence Bars Make it Easier to Digest Information



From Exercise 4

*Strongly preferred



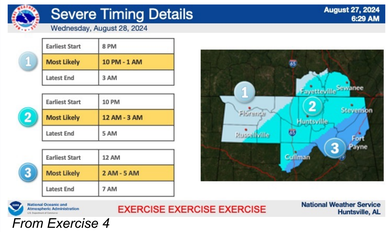
"[It] gives you a very quick snapshot and you know exactly what's going on…we're all really, really busy…and that's just quick and to the point and looks great."

However: "It looks like that no matter where you're at in the CWA, you have a medium confidence of [flooding]. No matter where you're at in the CWA... But is that a fair assessment?"

4+ Days Lead Time Necessary for Some Threats

- Winter weather & flood preparations begin 4+ days ahead:
  - Flood preparations MUST be *complete* before rain falls (e.g., clearing debris from streams)
  - Fire crews must be alerted before their days off (e.g., to be prepared to be called in)
- Partners understand meteorologist's confidence increases as the event approaches; provide updates

Planning Decisions Require Details on Timing



From Exercise 4

Emergency services "would probably make sure that our staff was in…by that earliest start time, and then…our preliminary plan" would be to release staff after the latest end time. School systems need an idea of what part of their day might be impacted.



From Exercise 2

Communicates risk, visualizes timing, and implies storm motion.

Additional Findings

- Threats (usually) differ across the CWA and partners want information about that.
- Some decisions depend on the potential for higher-end tornadoes.
- Matching up a current forecast scenario with past events helps with decision making.
- "Your words matter a lot… expertise is not something that's replicated in [static graphic]."
- Loops are helpful for gauging how an event might sweep through; they look at: speed of the system, severity, duration, wind speeds, and whether the system would become stationary.

Acknowledgements

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